Remarks

Applicants respond to the Office Action dated 15 January 2002 by amending claims 1, 2, 3, 4, and 8. Claim 10 is cancelled and new claims 29 to 32 are added. The claim amendments are fully supported by the specification and add no new matter to the patent application. The recitation in claim 1 that the copolymer is formed by reacting one or more monomers having pendant epoxy groups with one or more diluent monomers or polymers selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers is supported on page 11, line 21 to page 12, line 11. The recitation in claim 1 that the copolymer is attached to the surface of the substrate by formation of covalent bonds was in original claim 1. The recitation that the epoxy groups can form a covalent bond with the target molecules was in original claim 1.

The composition recited in new claim 29 is supported in the specification at page 18, line 21 to page 19, line 2. Support for the recitation that the diluent monomers or polymers are hydrophilic in new claim 30 is on page 12, lines 18 to 20. Page 12, lines 18 to 20 also supports the recitation in new claim 31 that the diluent monomer is an acrylamide or a vinyl pyrrolidone. The recitation in new claim 32 that the photoreactive group is an aryl ketone is on page 15, line 15 to page 16, line 14.

Attached hereto is a marked up version of the changes made to the specification and claims by the current amendment. The attached sheet is captioned "Version with Markings to Show Changes Made".

Claims 1 to 9 and 29 to 32 are pending.

Specification

The trademarks in the application have been capitalized. The trademarks NUCLEOLINK™, REACTI-BIND™, and DNA-BIND™ are written in capital letters. Each is also denoted as a trademark with the use of the superscript TM. The trademarked products are described in the specification.

Rejections based on 35 U.S.C. § 112

Claims 1 to 10 were rejected under 35 U.S.C. § 112 as indefinite. Applicants submit that the pending claims are definite.

Claim 1 recites that the copolymer of the reagent composition is attached to the surface of the substrate by formation of a covalent bond. The epoxide groups can form a covalent bond with the target molecule.

Claim 1 recites that the reagent composition comprises a copolymer. The copolymer is attached to the substrate. The substrate is not part of the reagent composition.

Claims 2 to 4 recite a reagent composition; there is proper antecedent basis for the reagent composition.

Claim 2 recites the monomer having an epoxide group that is selected from the group consiting of glycidyl acrylate, glycidyl methacrylate, allylglycidyl ether, and glycidyl vinyl ether.

Claim 3 provides that X is a radical selected from a group of four different formulas.

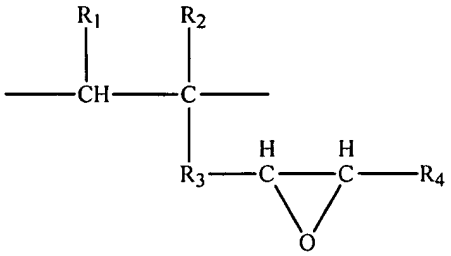
Claim 8 recites that the reagent composition can further comprise one or more photoreactive groups.

Rejections based on 35 U.S.C. § 102

Claims 1-3 and 8 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,332,694 to Kalal et al. (hereinafter "Kalal"). Applicants submit that the pending claims are not anticipated by Kalal.

Claim 1 of the present invention provides a reagent composition comprising a copolymer formed by reacting one or more monomers having pendant epoxy groups with one or more diluent monomers or polymers. The diluent monomers or polymers are selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers.

Kalal discloses a three dimensional carrier comprising an inorganic porous material and an unextractably sorbed reactive polymer of the general formula:



where R_1, R_2, and R_4 are hydrogen, an alkyl with 1 to 5 carbons, or an aryl. R_3 is the group

-$COO-(CH_2)_n$-.

Kalal discloses a polymer prepared from a monomer containing a pendant epoxy group. Kalal does not teach or suggest that the monomer containing a pendant epoxy group is reacted with one or more diluent monomers or polymers selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers.

Further, Kalal discloses a polymer that is sorbed onto a porous substrate. There is no teaching that the sorbed material is covalently attached to the substrate.

Kalal does not teach all the claim limitations of claim 1 and does not anticipate this claim. Consequently, Kalal does not anticipate dependent claims 2, 3, and 8. Applicants respectfully request withdrawal of the anticipation rejection based on Kalal.

Claim 1 was rejected as being anticipated by Nagasawa et al., J. Applied Biochemistry, vol. 7, pp. 430-437 (1985) (hereinafter "Nagasawa"). Applicants submit that claim 1 is not anticipated by Nagasawa.

Nagasawa discloses the activation of Sepharose beads with 1,4-bis(2,3-epoxypropoxy)butane.

Nagasawa does not disclose that the monomer containing an epoxide, in this case the 1,4-bis(2,3-epoxypropoxy)butane, can react with one or more diluent monomers or polymers selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers. Rather, the epoxide containing compound is reacted with Sepharose; Shepharose is a gel of agarose in the form of beads.

Nagasawa does not teach or suggest all the limitations of claim 1 and does not anticipate this claim. Applicants respectfully request removal of the anticipation rejection based on Nagasawa.

Rejections based on 35 U.S.C. § 103(a)

Claims 1-3 and 5-8 were rejected as obvious over Kalal and U.S. Patent No. 5,919,626 to Shi et al. (hereinafter "Shi"). Applicants submit that claims 1-3 and 5-8 are not obvious based on the combination of Kalal and Shi.

Shi discloses a method for immobilizing a nucleic acid molecule to a solid substrate. A silane compound is applied to a solid substrate and cured. The silane coated substrate is then

coupled with unmodified nucleic acid molecules having either a terminal 3' OH or a terminal 5' OH. The silane can be 3-glycidoxy propyl-trimethoxysilane.

Shi does not teach or suggest that a monomer having an epoxy group can react with a one or more diluent monomers or polymers selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers. Rather, the epoxy containing silane is polymerized. There is no diluent monomer or polymer.

Shi does not remove the deficiencies noted above for Kalal. The combination of Shi and Kalal does not teach or suggest that the monomer containing a pendant epoxy group is reacted with one or more diluent monomers or polymers selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers. In both references, the epoxy containing monomer is polymerized with other epoxy containing monomers. There is no diluent monomer or polymer.

The references do not teach or suggest all the limitations of claim 1. Thus, claim 1 and dependent claims 2-3 and 5-8 are not obvious over the combination of Shi and Kalal. Applicants respectfully request the withdrawal of the obviousness rejection based on these references.

Claims 1 and 5-10 were rejected as obvious over U.S. Patent No. 5,942,555 to Swanson et al. (hereinafter "Swanson") and Shi. Applicants submit that claims 1 and 5-9 are not obvious based on the combination of Swanson and Shi. The rejection with respect to claim 10 is moot because this claim has been cancelled from the application.

Swanson discloses a photoactivatable reagent having one or more photoactivatable groups and one or more sulfhydryl (or other chain transfer) groups. The reagent can be used to initiate the polymerization of ethylenically unsaturated monomers.

Swanson does not remove the deficiencies of Shi. The combination of references does not teach or suggest that the monomer containing a pendant epoxy group is reacted with one or more diluent monomers or polymers selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers. In both references, the epoxy containing monomer is polymerized. There is no diluent monomer or polymer.

Swanson and Shi do not teach or suggest all limitations of claim 1. Claim 1 and dependent claims 5 to 9 are not obvious based on the references. Applicants respectfully request removal of the obviousness rejection based on the combination of Swanson and Shi.

Claims 1-10 were rejected as obvious over the combination of Swanson, Shi, and Kalal. Applicants submit that the pending claims are not obvious over this combination of references.

Kalal does not remove the deficiencies noted above for the combination of Swanson and Shi. The references do not teach or suggest that the monomer containing a pendant epoxy group is reacted with one or more diluent monomers or polymers selected from the group consisting of acrylics, vinyl, nylons, polyurethanes, and polyethers. Rather, the epoxy containing monomer is polymerized with other epoxy containing monomers. There is no diluent monomer or polymer.

Swanson, Shi, and Kalal do not teach or suggest all limitations of claim 1. Claim 1 and claims the respective dependent claims are not obvious based on the references. Applicants respectfully request removal of the obviousness rejection based on the combination of Swanson, Shi, and Kalal.

Applicants submit that all the pending claims 1 to 9 and 29 to 32 are in proper form for allowance. Applicants respectfully request a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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Date: April 24, 2002

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Version with Marking to Show Changes Made

In the specification:

Please insert the following text at the beginning of the specification:

The present invention was made, at least in part, with the support of the United States Government under grant 1 R43 AI35343-01 awarded by the National Institute of Health. The government may have certain rights in this invention.

Replace the last paragraph on page 2 with the following:

Only relatively few approaches to immobilizing DNA, to date, have found their way into commercial products. One such product for immobilizing oligonucleotides onto microwell plates is known as ["NucleoLink™"] NUCLEOLINK™, and is available from Nalge Nunc International (see, e.g., Nunc Tech Note Vol. 3, No. 17). In this product, the DNA is reacted with a carbodiimide to activate 5'-phosphate groups, which then react with functional groups on the surface. Disadvantages of this approach are that it requires the extra step of adding the carbodiimide reagent as well as a five hour reaction time for immobilization of DNA, and it is limited to a single type of substrate material.

Replace the first paragraph on page 3 with the following:

As another example, Pierce has introduced a proprietary DNA immobilization product known as ["Reacti-Bind™ DNA Coating Solutions" (see "Instructions - Reacti-Bind™ DNA Coating Solution" 1/1/1997)] REACTI-BIND™ DNA Coating Solutions (see Instructions - REACTI-BIND™ DNA Coating Solution 1/1/1997). This product is a solution that is mixed with DNA and applied to surfaces such as polystyrene or polypropylene. After overnight incubation, the solution is removed, the surface washed with buffer and dried, after which it is ready for hybridization. Although the product literature describes it as being useful for all common plastic surfaces used in the laboratory, it does have some limitations. For example, Applicants were not able to demonstrate useful immobilization of DNA onto polypropylene

using the manufacturer's instructions. Furthermore, this product requires large amounts of DNA. The instructions indicate that the DNA should be used at a concentration between 0.5 and 5 μg/ml.

In the claims:

Claim 10 is cancelled without prejudice or disclaimer.

1. (Once Amended) A reagent composition for attaching a target molecule to the surface of a substrate, the reagent composition comprising a [polymeric backbone adapted to be covalently attached to the surface and comprising one or more pendent epoxide groups adapted to form covalent bonds with corresponding functional groups on the target molecule] copolymer having one or more pendant epoxy groups, the copolymer formed by reacting a mixture comprising

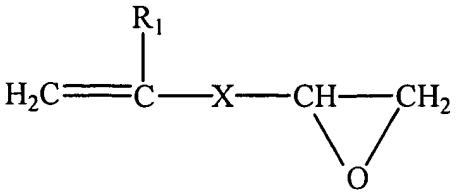
(a) one or more monomers having pendant epoxy groups; and

(b) one or more diluent monomers or polymers, wherein the diluent monomers or polymers are selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers,

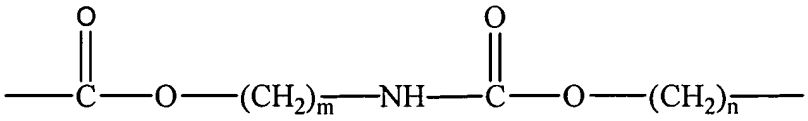
wherein the copolymer is attached to the surface of the substrate by formation of a covalent bond and the epoxy group can form a covalent bond with the target molecule.

2. (Once Amended) A reagent composition according to claim 1 wherein the [reagent comprises a polymer formed by the polymerization of one or more monomers] monomer having a pendant epoxide group is selected from the group consisting of glycidyl acrylate, glycidyl methacrylate, allylglycidyl ether, and glycidyl vinyl ether.

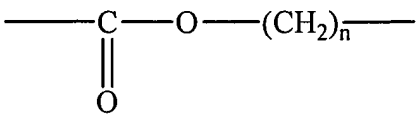
3. (Once Amended) A reagent composition according to claim 1 wherein the [reagent comprises a polymer formed by the polymerization of one or more monomers] monomer having a pendant epoxide group is of the formula:



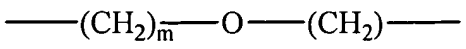
where R_1 is either CH_3 or H and X is a [noninterfering] radical[, preferably] selected from the group:



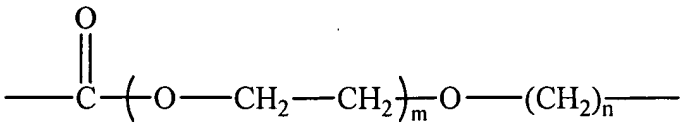
where m = 2-6 and n = 1-10;



where n [-] = 1-10



where m = 0 or 1[, and]; or



where m = 1-20 and n = 1-10.

4. (Once Amended) A reagent composition according to claim 1 wherein the reagent composition comprises a [polymer] copolymer synthesized by reacting hydroxyl- or amine-containing polymers with diepoxides.

8. (Once Amended) A reagent composition according to claim 1 wherein the composition further comprises one or more [latent reactive groups comprising] photoreactive groups for covalently attaching the reagent composition to the surface upon application of energy from a suitable source.

29. (New) A reagent composition for attaching a target molecule to the surface of a substrate, the reagent composition comprising a copolymer formed by reacting a mixture comprising:

(a) one or more monomers having pendant epoxy groups in an amount of 5 to 25 mole percent based on the weight of the copolymer;

(b) one or more diluent monomers or polymers, wherein the diluent monomers or polymers are selected from the group consisting of acrylics, vinyls, nylons, polyurethanes, and polyethers; and

(c) one or more monomers having a photoreactive group in an amount of 0.1 to 5 mole percent based on the weight of the copolymer,

wherein the photoreactive group can form a covalent bond with the surface of the substrate to attach the copolymer to the substrate and the epoxy group can form a covalent bond with the target molecule.

30. (New) The reagent composition of claim 29, wherein the diluent monomers or polymers are hydrophilic.

31. (New) The reagent composition of claim 29, wherein the diluent monomer is an acrylamide or a vinyl pyrrolidone.

32. (New) The reagent composition of claim 29, wherein the photoreactive group is an aryl ketone.